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ABSTRACT

Two groups of students at risk of not developing adequate mathematical knowledge and skills are (1) the "typical or usual" and (2) "the nominal mathematics students"--those who do not achieve at a satisfactory level in mathematics and/or do not enroll in mathematics courses beyond typical required courses. This digest provides information for preventing and reducing the problems related to at-risk students. Included are: (1) descriptions of the potential dropout and of the nominal mathematics student; (2) a summary of at-risk students; and (3) an outline of ways to reduce the number of mathematically at-risk students. This section lists some variables associated with elementary school mathematics programs which in various combinations tend to produce a lower percentage of dropouts and a lower percentage of nominal mathematics students. Seventeen references are listed. (YP)



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# STUDENTS AT RISK IN MATHEMATICS:

# IMPLICATIONS FOR ELEMENTARY SCHOOLS

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ERIC/SMEAC Mathematics Education Digest EDO-SE-88-6 No. 2, 1988

# STUDENTS AT RISK IN MATHEMATICS: IMPLICATIONS FOR ELEMENTARY SCHOOLS

Two groups of students in schools are learning substantially less mathematics than they should. They are entering the work-force unable to use mathematics effectively, and probably account for a significant amount of the reason national assessment scores in mathematics do not show much improvement.

The first group consists of the "typical or usual" potential school dropout and underachiever. The second group of students, the group we term "nominal mathematics students," stay in high school and may even go on to college, but their mathematics education is not adequate to allow them maximum educational and life choices. Both of these groups, the potential dropout and the nominal mathematics student, are at risk of not developing adequate mathematical knowledge and skills and contributing less than what they might to their own lives and to society.

What can the elementary school staff do to address the problems of these at-risk students? This digest and the publication on which it is based were developed to help schools and teachers know some of the problems the students have, what the elementary school staff can do, and what elementary classroom teachers can do. Most of the recommended actions will help not only these students, but also others.

## Who are the potential dropouts?

Data have been accumulated and analyzed on the numbers and characteristics of potential dropouts. Recent data indicate over 20 percent of the students who enroll in American schools become part of this group. In many urban and rural areas the percentage of students who dropout is much higher.

It is estimated that two-thirds of these students are from families at the poverty level. They frequently differ from their more successful peers in development of self-esteem, task performance, school achievement, and career and cultural aspirations. They often develop behavior patterns that create problems in school.

These students may never fulfill their personal potential and they may become an economic burden on society. Who are the nominal mathematics students?

Analyses of National Assessment of Educational Progress (NAEP) data and achievement test scores from states indicate that from 20 to 25 percent of the school population who complete high school do not perform at a satisfactory level on many basic test questions. Correlations from research studies indicate most of these students only complete the basic required mathematics courses. They usually have taken no mathematics elective courses.

Unlike the potential dropout, "nominal mathematics students" seldom cause mathematics teachers major difficulties in school. They do not manifest behavior problems and they are not viewed as potential problems for society. These students are at risk because their level of understanding and competence in mathematics is substantially below desired levels. These students are not likely to continue in mathematics beyond basic requirements in high school, nor are they likely to consider a career that uses mathematics. Many of these students also will not be able to use mathematics when needed in their daily lives.

## What are some of the causes of at-risk students in mathematics?

There are several variables that tend to cause students to fall into the at-risk groups in mathematics. Several of these causes can be prevented, reduced, or modified to help make students more successful in school and in mathematics in particular.

Some students, especially minority students, are not able to see themselves and their backgrounds reflected in the curricula. The curriculum in many cases does not provide for cultural differences.

Females have tended to be especially at risk in many mathematics courses or classrooms because mathematics has frequently been viewed as a male domain. Instructional materials, family and peer behaviors and expectations, and teacher behaviors and expectations have frequently reinforced this attitude.

Some students develop anxieties that interfere with studying, learning, and using mathematics. These anxieties can interfere with learning and performance and cause the student to underperform and/or to elect to avoid mathematics courses and experiences.

Some students have not succeeded in mathematics classes due to learning and behavior problems, sensory handicaps, and physical and health impairments. These conditions do not need to limit the mathematical learning of these students. In many cases, mathematically related careers can provide these students with excellent employment opportunities.

Some school age youth are less likely to complete elementary and secondary school mathematics programs successfully and/or to acquire the skills necessary for higher education and employment because they are enrolled in classes where the curriculum and instruction are not appropriate to foster desired attitudes, aspirations, skills, and understandings related to mathematics. For many students the curriculum is neither interesting nor relevant; the very structure of the curriculum serves to "turn off" students. The mathematics curriculum often lacks real world problems and applications, is repetitious, and focuses too much on product and not on process.

Mathematics instruction also frequently suffers from at least five problems.

* the usual classroom routine is not effective for developing new concepts;
* the pace is wrong for many students;
* drill and practice are ineffective;
* diagnosis and treatment of error are often superficial; and
* instruction does not provide sufficient hands-on experiences.

**What can an elementary school staff do to help reduce the number of mathematically at-risk pupils?**

Data indicate a strong relationship exists between early mathematics achievement and later mathematics achievement. Mathematics competency appears to be learned. Mathematics programs that are planned and operated to attempt to ensure success tend to have fewer remedial pupils and fewer nominal mathematics pupils. Prevention is far more successful than remediation; early remediation is more successful than late remediation.

While more research is needed to develop better models, combinations of the following variables are associated with school programs that tend to have a lower percentage of dropouts and a lower percentage of nominal mathematics students.

The elementary school mathematics program

* stresses goals and objectives;
* stresses building knowledge and developing and using skills in a coordinated curriculum;
* provides mathematics instruction early (kindergarten and grade 1) and continues;
* provides time for mathematics instruction on a regular bases;
* stresses real-life use of mathematics;
* uses activity based learning;
* uses a variety of instructional approaches to accommodate learning styles, preferences,and needs;
* provides enrichment and adequate resources for all classes;
* provides for transition from grade to grade;
* emphasizes a continuous progress approach and/or cooperative learning techniques;
* stresses effective use of homework;
* has a program for involving parents;
* uses a diagnostic and prescriptive approach in instruction to help identify pupil errors and to keep them from falling behind grade level expectations;
* has an early identification and intervention program for pupils with learning problems;
* uses frequent monitoring to identify pupils with possible problems;
* maintains careful records of pupil progress;
* frequently uses a special program (in class or pull-out) and special assistance (tutoring)to help pupils who have had difficulty in mathematics; and
* provides intensive individual attention to individuals with sustained problems for a period of time.

**What effective programs for elementary school mathematics are available to help prevent and reduce the number of at-risk pupils?**

Research and development on programs for elementary school mathematics continues. There are, however, several programs available through the National Diffusion Network (NDN) and also listed in the ERIC database.

For assistance in identifying programs available through the NDN, contact your NDN state facilitator or:

National Diffusion Network Program
Office of Educational Research and Improvement
U.S. Department of Education
555 New Jersey Avenue, NW
Washington, DC 20208-1525
Telephone: (202) 357-6134

To purchase a publication containing a listing of programs contact:

ERIC Clearinghouse for Science, Mathematics, and Environmental Education
1200 Chambers Road, Room 310
Columbus, OH 43212
Telephone: (614) 292-6717

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